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The treatment of disease by light and heat

BY

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DU TRAITEMENT DES MALADIES PAR LA LUMIÈRE ET LA CHALEUR

THE TREATMENT OF DISEASE BY LIGHT AND HEAT

by Dr KNOWSLEY SIBLEY,

Senior physician to out-patients at the North-West London hospital.

In August, 1896, I published the results obtained after two years work on the treatment of rheumatism and allied affections by the local application of dry hot air¹.

In 1897 I wrote an article on the same method of treatment in cases of acute and chronic gout².

Last year I read a paper before the Annual Meeting of the British Medical Association on the "Therapeutics of Light and Heat"³.

I now propose to describe my latest investigations on the same subject.

The utility of heat with or without the addition of light has now become so generally recognised by the medical profession that most Hospitals and Hydro-therapeutic establishments in England and on the Continent are at the present time using apparatuses of various designs for administering this treatment. As a rule the more simple the mechanism of the apparatus for producing the necessary therapeutic agents, the better the results obtained, and naturally for purposes of general utility the same apparatus must be adjustable to treat any part of the body, and it must not be necessary to have an apparatus of a different shape or size for the application of heat (and light) to different regions.

Of recent years physicians have shown a marked tendency to treat many complaints by local or external methods, in contradistinction to treatment by the administering of drugs and internal remedies. Even cases of heart disease are now much improved, if not cured, by regulated exercises and baths (Nauheim treatment). In many cases this improvement has taken place without the assistance of drugs of any kind. And again, many cases of heart disease which had failed to show any benefit by a carefully regulated course of internal medicines have been greatly

1. *Lancet*, 1896.

2. *Lancet*, 1897.

3. *British Medical Journal*, 1899.

improved by treatment by regulated exercises or resistance movements combined with saline effervescent baths. It is not intended in any way to depreciate the value of internal remedies, which often prove of great use when combined with external methods; but the object of the writer is to emphasize the fact, that the external method is often the more powerful and effective means of dealing with disease. Rheumatism in its various forms has from times of old been treated by external applications, such as blisters, cupping, leeches, sun baths, hot sand, friction, warmth, movements, massage, electricity and the like. A large number of baths and moist hot air methods have been in use for some time, in fact, every health resort has its own particular bath, with or without an electrical current. But the feature which at once appears fatal to satisfactory results is that in all the older kinds a moist and not a dry heat was applied to the affected part. As the result it was impossible to obtain a really high temperature, as moist heat of from 115° to 120° Fahrenheit is unbearable, and much above this produces scalds. So with all these older methods what seemed to be the important element in the treatment — namely, heat of from 200° to 500° F. — could not be applied, or at any rate not for a sufficient length of time.

Each operation should take about one hour and a half to two hours, that is to say, the part of the body is exposed to the therapeutic agent for from 30 minutes to one hour, and the patient should then allow plenty of time to cool down before going out into the external air.

The part under treatment should be quite undressed and the naked skin exposed to the heat, if the skin is very sensitive one or more layers of lint should be lightly placed over the limb, and it must be noted in passing that each layer of lint probably takes off roughly 100° F. of heat from the part treated.

Under ordinary circumstances, the temperature is gradually raised until the patient feels it is hot enough for comfort, and then a general free perspiration breaks out first on the part under treatment and then over the whole body; at the same time the body temperature is temporarily raised from a half to three degrees, or even more a physiological effect of very great scientific interest. Also the pulse is increased in frequency and to a less marked extent the respiration. A few minutes after the operation is completed, the pulse, respiration and temperature return to the normal or previous condition. Usually about an hour after the pulse is found to be slower and stronger than it was before treatment; this was especially noticed in some cases of weak and enfeebled hearts. In cases accompanied with much pain, this is almost at once

relieved, and under the influence of heat the parts soon become more lax and supple. When the limb is first removed^o there is often a transient erythematous blush. After the bath the whole body is briskly and lightly rubbed down with a dry towel and the limb sometimes gently massaged and passive manipulation performed if necessary.

More diseased conditions than might at first sight be imagined are benefited by local hot air treatment. My rule at the hospital for some years has been, when a patient suffering from any complaint does not improve after a few weeks routine drug treatment, to order the hot air treatment, and I must say that in the majority of cases improvement very quickly shows itself, often to a marked degree.

The cases for which this treatment is especially indicated are all forms of *arthritis*, whether of rheumatic, gouty, neurotic (including under this head cases due to brain, spinal, or peripheral nerve trouble), tuberculous, or traumatic origin, particularly when the process is chronic. I can say with confidence that almost every kind of joint mischief, whether the result of injury or disease, is greatly benefited by local application of dry hot air. Under joint diseases the following would be included, gout (acute, subacute, and chronic), rheumatism (acute, subacute, and chronic), gonorrheal rheumatism, rheumatoid arthritis, serofulous disease of joints (*morbus coxæ*), synovitis, bursitis, periostitis, including syphilitic, and all forms of adhesions, and various changes in the joint the indirect result of nerve troubles.

With regard to *injuries* (recent and old-standing) synovitis, bursitis, and all degrees of stiffness, adhesions, and various conditions of immobility a few words are desirable. Many of these cases are greatly improved simply by the local application of heat, but, of course, if severe or old-standing, surgical interference by breaking down adhesions greatly increases and accelerates the cure. It is in most cases better to give a course of local treatment before any attempt is made to break down adhesions. Then an anæsthetic may be administered and the adhesions broken down and joints freely moved and placed immediately afterwards in a hot air apparatus. This frequently prevents the subsequent effusion and greatly diminishes the pain; in fact, I have notes of several cases of severe old-standing adhesions treated in this way with little or no pain or even effusion following the operation and with very satisfactory results.

Hysterical joints I have found to be amenable to this treatment.

So again, cases of either local or general *malnutrition*, especially cases of feeble circulation, due to local causes such as injuries to blood vessels or nerves, chilblains, cold extremities, including Raynaud's disease, and

deformities due to arrested nutrition usually improve, as do most forms of localised œdema.

Most forms of *neuritis*, both gouty and those of a more directly nervous nature (such as peripheral neuritis and traumatic neuritis) do remarkably well; and also sciatica, lumbago, and allied affections, including neuralgia following herpes zoster, are usually cured, as also are head-aches, insomnia and the like.

I have had most satisfactory results in a large number of cases of *chorea*. The movements of the limb under treatment rapidly subside while under the influence of the heat, usually returning with less severity shortly afterwards.

Epilepsy appears often much benefited by treatment, in many cases combined with bromide taken internally. Some cases, however, have greatly improved both as to the duration and frequency of the fits with hot air treatment alone.

Some forms of *paralysis*, especially lead palsy and paralysis due to injuries to the nerve trunks, do well under the treatment.

Cases of old-standing paralysis due to central lesions do not improve to the same extent, but these, especially those associated with coldness of the paralysed limb, are in time benefited, more particularly with respect to the nutrition and warmth of the part.

Menière's disease was in three cases greatly relieved.

Chronic *bronchitis* (especially cases associated with *Bright's disease* and high tension) was greatly relieved as were also cases of asthma and diabetes.

I have found the cough greatly relieved in some cases of phtisis, even during the active stage of the disease, and patients have gained weight and expressed themselves as improved.

A good deal might be said of the effect of the dry hot air on the *heart*; in fact, it would appear that what has been written on the Schott or Nauheim treatment might very well be applied to this. As probably the therapeutic effect of the saline effervescent baths is one primarily of gentle stimulation to the cutaneous nerves, so here again the application of dry heat is an excellent stimulus to cutaneous nerves and blood vessels, and many cases of chronic heart disease undoubtedly do very well; indeed, my experience teaches me that cases need rarely, if ever, be refused for treatment on account of heart mischief.

Many of the dry forms of *skin disease*, such as psoriasis and dry eczema, do very well, so also in the case of scleroderma (where the patient has never been known to perspire from the affected regions) the skin becomes accustomed to sweat after persevering with the dry hot air.

Chronic *ulcers* and local inflammatory conditions, such as boils, are cured, as are cases of erythema nodosum.

It is frequently asked if we should administer the treatment to women during menstruation. The general effect of the heat is to increase the catamenia, and therefore in cases in which this is excessive it would not be desirable. I find that, speaking generally, cases of scanty, and especially of painful menstruation, are benefited by the application of heat to the pelvic regions.

Amenorrhœa, especially in young anæmic girls, is an especial indication for treatment at about the time the period is due.

It has recently been pointed out that many of the chronic back aches and pelvic pains of women are probably due to rheumatic changes in the pelvic and uterine ligaments and appendages. These are greatly relieved, and often cured, as might be expected, by this form of treatment.

I must now allude to some cases which were not improved by the treatment.

Well-defined Locomotor Ataxy. — A few cases I have treated did not appear to be altered so far as the lightning pains or the ataxic gait were concerned.

Cases of Paralysis Agitans. — Although there was improvement in the general condition of the patient, and increased strength in the limbs treated, there was not apparent diminution in the movements, either during the process of exposure to heat, or as the result of treatment.

To *writer's cramp* the same remarks apply.

The question of the desirability of treating certain acute cases of gouty or rheumatic arthritis is a most important one, and I still feel unable to formulate definite opinions upon it. The doubt would seem to be particularly strong while pyrexia, considerable pain, and recent infiltration of the tissues in and around the joints are present. The more localised the condition, with these symptoms, the more should I hesitate to predict the result of the first few baths.

The immediate result of the treatment in these cases may be to disseminate the inflammatory process and convert what was at first a local arthritis into a general one with consequence that patient and doctor became alarmed and the treatment is stopped. If treatment be persevered with, and often if in the first instance heat was only applied to one limb, then a whole bath is administered when the condition has become general, the disease rapidly subsides; but the possibility of such an exacerbation of symptoms must be borne in mind from the commencement.

A similar result is commonly met with in acute gout with great tume-

faction and excruciating pain in one joint. If the heat process be applied to this joint it will soon relieve the symptoms, swelling will subside, and pain disappear. Probably, however, the same condition (even sometimes more acute) will appear within a few hours or during the next day in the corresponding part of the opposite limb. This of course frequently happens in cases of acute gout when treated by drugs, but the likelihood of its occurrence after the heat bath must not be overlooked.

I now propose to mention some facts in connexion with the addition of luminous rays to non-luminous radiant heat.

At the present time I am especially interested in experiments with an attempt to determine which of the light rays have the most penetrating therapeutic effect.

It is known, for instance, that the violet end of the spectrum contains the rays which produce sunburn. By the simple means of intervening pieces of coloured glass in the light rays it is possible to cut off whatever rays are desired and to only permit rays of one or more colour to be thrown on the part under treatment. Thus with a red glass screen all the violet which are the irritating burning rays are shut off and a very comfortable soothing red heat is produced. At the same time the temperature is but very slightly affected.

Very little at present is known about the effect of the various light rays on the animal organism, but a great many experiments on this subject have been made on plants, and the results in this connexion are certainly worth noting.

The hæmoglobin of the animal cell has been compared to, and has many functional similarities with the chlorophyll of the vegetable cell.

The necessity of the human body for light and air is of universal recognition. People become anæmic when deprived of sunlight; and so also the entire life of a plant depends upon the light on the cells which contain chlorophyll.

The following facts may be of interest in connexion with this subject :

A. — GENERAL.

I. *Action of Rays of different Refrangibility.* — The rays of different refrangibility which together constitute sunlight, and appear as variously coloured bands in the spectrum, vary in their physiological action on the processes of plant life.

Chemical changes, so far as they are in the main dependent on light, are produced chiefly or solely by rays of medium or low refrangibility

(namely, the red, orange, yellow, or green). This is the case for instance with the production of the green colour of chlorophyll, the decomposition of carbon dioxide, and the formation of chlorophyll, starch, or sugar.

On the other hand, the rays of high refrangibility (the blue or violet as well as the invisible ultra-violet rays) are the principal or the only ones which produce mechanical changes, so far as these are dependent on light. It is these rays which influence the rapidity of growth, alter the movements of the protoplasm, compel swarın spores to adopt a definite direction in their motion, and change the tension of the tissues of the mobile organs of many leaves, hence causing movements.

2. *Action of Light of different Intensities.* — That the action of light on plants varies with its intensity, as does temperature with its elevation, admits of no doubt, and is obvious in all physiological observations.

3. *Penetration of the Rays of Light into the Plant.* — The rays of greatest refrangibility are in general almost entirely absorbed by the superficial layers of tissue, while the red light penetrates most deeply.

B. — SPECIAL.

Chemical Action of Light on Plants. (a) *Formation of Chlorophyll.* — All the visible parts of the solar spectrum have the power of turning the etiolated chlorophyll granules green, but the yellow rays and those nearest them on each side of the spectrum are the most powerful, and this is also the case with the exhalation of oxygen from cells containing chlorophyll.

(b) *The Decomposition of Carbon Dioxide.* — The influence of light upon the evolution of oxygen is greater the more carbonic acid is contained in the air; only those rays which are visible have the power of decomposing carbonic dioxide, and those which appear brightest to the eye (the yellow rays) are alone as efficacious in this process as all the others put together.

(c) *The Formation of Starch in Chlorophyll Granules.* — The formation of starch is a function of chlorophyll granules exposed to light, its absorption a function of chlorophyll granules not exposed to light. The formation of starch in chlorophyll granules depends on conditions which favour assimilation; and the principal feature of the process, the evolution of oxygen, proceeds vigorously in light consisting of red, orange, yellow, and to a certain extent of green rays; while the more strongly refrangible

half of the spectrum, consisting of green, blue, violet and ultra-violet rays, has only a very slight effect.

(d) *Mechanical action of Light on Plants.* — Without discussing the question, it may be briefly said that the influence of light on the movements of protoplasm varies according to the nature of the motion.

(e) *Cell Division and Growth.* — Light retards growth; but it is only the rays of high refrangibility, the blue, violet, and ultra-violet, which act in this way.

(f) *Action of Light on the Tension of the Tissue of the Organs of Leaves endowed with Motion.* — It is only the more refrangible rays that produce a paratonic effect, while the red rays are inert.

These few remarks on the actions of the various light rays upon plant life would seem to open up a wide field for experiment and observation with regard to the treatment of diseases by different light rays in addition to heat rays. It is probable that, as we learn more of the pathology of those conditions we are accustomed to treat, we shall be able to decide beforehand what particular coloured rays would be most serviceable to the treatment of any given disease.

Generally speaking, the therapeutic effects of light apart from heat may be divided into three categories : (1) The chemical rays of the sun or of electric light can produce inflammation of the superficial parts. (2) They can also penetrate through the epidermis into the dermis and the subcutaneous tissues. (3) They have the power of destroying germs on, in or close under the epidermis.

Charcot in 1859 expressed the view that ordinary sunburn or erythema solare was produced by the violet chemical rays of the spectrum, and this has been repeatedly proved since by various observers from experiments made on the snow mountains, where it has been shown that sunburn may be, and often is produced on part of the body which have only received the reflected rays from the snow and have not been exposed to the direct rays of the sun at all.

Wildmark has proved by experiment that this erythema solare is due to the action of the ultra-violet rays and the still more recent researches of Finsen have proved that this effect is shared though to a less extent by the more refrangible rays of the spectrum, the violet and blue rays.

Godneff has further shown that some chemical rays can act on silver chloride when placed in sealed glass tubes beneath the skin.

Downes and Blunt proved that sunlight could kill microbes, and this power was shown to be due to the blue, violet and ultra-violet rays.

Bie has experimentally shown that the sun's rays kill the bacillus pro-

digiosus in an hour and a half and more over that the rays from an electric arc lamp can kill a similar culture at a distance of 75 cm in about eight hours.

Finsen, by means of a complicated apparatus, concentrates the bactericidal chemical rays and eliminates the burning rays. It has been found that concentrated chemical light, used in this way, kills most pathogenic organisms in a very short time.

To sum up the subject, for the purposes of general utility of light treatment it is clear that, if it is desired to use rays which do not tend to produce burning of the superficial parts but which will penetrate into the tissues and produce a deep-seated effect, we must cut off the violet and use the red rays alone and *vice versa*.

As a matter of personal experience I have found the treatment by the use of the red rays far more soothing and less irritating in its effect than using the whole of the rays of the visible spectrum together.

With regard to the general effect of the luminous rays, there is no doubt that the addition of luminous rays to ordinary non-luminous radiant heat produces an increased diaphoresis. Patients who do not sweat with non-luminous heat very quickly do so when some light rays are added, and this is often noticeable even at a lower temperature than had been previously tried.

In conclusion, the whole subject of light and heat therapeutics is still in its infancy and although a great deal has already been discovered and some of the results obtained have far exceeded all expectation, it would appear that the subject is one which opens out a large field for future research.

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